TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

10.1 INTRODUCTION

This chapter is divided into two sections. The first section provides an assessment of the potential impacts on air quality from the construction and operation of the rail and associated infrastructure along the rail easement, and it discusses suitable mitigation and management measures to address potential impacts.

The air quality assessment evaluates the local climate of the region and the existing air quality in relation to particulate matter (PM, i.e. dust). Local meteorology is a key factor in assessing and identifying potential transport and dispersion of particulate matter across the rail line. Atmospheric dispersion modelling has been performed to quantify air quality impacts of particulate matter in conjunction with estimates of PM emissions during the operational life of the rail and infrastructure.

The second section of this chapter provides an assessment of the greenhouse gases (GHG) that will potentially be generated during the construction and operation of the railway. The potential abatement measures are discussed.

A detailed air quality and GHG Assessment for the Project was undertaken, (see Volume 5, Appendix 18 and Appendix 19, respectively).

10.2 AIR QUALITY

10.2.1 ASSESSMENT METHOD

The impacts on air quality of the activities associated with the operation of the rail have been assessed against *Environmental Protection Policy (Air) 2008* (EPP(Air)) air quality guidelines for total suspended particles (TSP), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}) and particulate matter with an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$). The EPP (Air) air quality objectives relevant to this air quality assessment are shown in Table 1. Dust deposition rates have also been assessed against relevant guidelines.

Fugitive emissions from coal wagons were estimated using the methodology presented in the Interim Report *Environmental Evaluation of Fugitive Coal Dust Emissions from Coal Trains Goonyella, Blackwater and Moura Coal Rail Systems*, prepared for Queensland Rail Limited (Connell Hatch, 2008).

Background concentrations were estimated based on air quality monitoring conducted at West Mackay by DERM. They are likely higher than the actual background dust levels along the rail easement.

The steady-state Gaussian dispersion model AUSPLUME was run with two annual meteorological datasets to compare the maximum time-averaged concentrations to their relevant guidelines. The two meteorological datasets were generated using a meteorological prediction model, The Air Pollution Model (TAPM), with one located close to Alpha, near the mine (for year 2008), and another one located close to Bowen, near the coal terminal.

Table 1. Air quality guidelines for particulate matter in Queensland

POLLUTANT	OBJECTIVE (µG/M3)	PROTECTION CATEGORY	AVERAGING PERIOD	ALLOWABLE EXCEEDANCES
Total Suspended Particulate (TSP)	90	Annual	EPP (Air)	Nil
Particulate Matter <10 µm (PM_{10})	50	24 hour	EPP (Air) and NEPM	5 days each year [a]
Particulate Matter <2.5 µm ($PM_{2.5}$)	25	24 hour	EPP (Air)	Nil
	8	Annual	EPP (Air)	Nil
Dust Deposition	2g/m²/month (incremental)	Monthly	Qld and NSW	Nil

[a] 5 days of each year allowable exceedances are set to exclude days with regional dust storms or bushfires. These events are not impacted by local sources.

As it was not feasible to model the entire length of the proposed rail, a representative section of the rail was modelled. Terrain effects were not accounted for in AUSPLUME as a non-specific section of track was modelled. The total length of the rail modelled was 12.4 km, represented as a straight line.

The dust emissions were modelled as a series of joined area sources that represented the dust plumes generated from trains running on two proposed tracks. Each source was 20 m wide, to simulate a scenario where the two tracks are located within a land strip of 20 m wide, well within the proposed 100 m rail alignment. A total number of 120 sources was modelled.

A line of receptors was set up, perpendicular to the modelled rail line, crossing the line at the middle. The gap between receptors was 25 m near the track, and 50 m further away. The furthest receptors are 2 km away from the track on both sides of the rail.

A detailed description of the methods used for the air quality assessment is at Volume 5, Appendix 18.

10.2.2 DESCRIPTION OF ENVIRONMENTAL VALUES

Environmental values in the form of ambient air quality for the rail were considered for this project with respect to relevant Queensland legislation. Associated air quality for this assessment was comprised of particulate matter (PM), which is typically referred to as dust. Air quality indicators of interest for this project are PM_{10}, $PM_{2.5}$ and TSP (total suspended particulate matter)

10.2.2.1 Meteorology

The rail easement is subject to a tropical climate, with hot and wet summers, and cool and dry winters. Summers are frequently influenced by tropical cyclones and lows, which can cause heavy rainfall in the coastal areas. The wind direction is predominantly from the east, south east and north east. There are gradual changes of climate from the coastal end to the mine end of the rail, with average annual rainfall and relative humidity decreasing as the track moves inland, and average annual temperature increasing as the track moves inland.

A climate summary relevant to air quality is provided below and a detailed description of climate at the project area is provided in Volume 3, Chapter 2.

Climate conditions for the Project have been assessed for three project locations:

- coal terminal at Abbot Point – the start of the rail;
- central region of the rail; and
- mine site - the end of the rail.

Based on meteorological data collected twice a day at 9 am and 3 pm at Moranbah Water Treatment Plant, and Collinsville (two BOM weather stations), the climate for the central part of the rail is summarised as below, in comparison with the mine inland and the coal terminal at the coast:

- based on wind roses from Proserpine and Moranbah, long term average 9 am winds for the central section of the rail are predominately from the south-east to east, with calms between 7-24% of the monitored period. Long term average 3 pm winds are generally stronger than for 9 am, and from the south-east to east. Calms form 0.5-15% of 3 pm winds;
- relative humidity is the highest during the summer, autumn and winter months, and lowest during the spring months. Relative humidity is typically the highest at the coal terminal and the lowest at the mine site. Relative humidity is affected by the distance from the sea with stations further from the ocean having less water vapour available and hence lower relative humidity;
- rainfall is the highest during summer and lowest during winter, with a total annual rainfall approximately 590 mm for Moranbah and 710 mm for Collinsville. Rainfall is higher towards the coast; and
- temperature is warm year-round. In the hot summer months, the mean daily maximum temperature reaches over 31°C at the coal terminal, over 35°C at the mine, and in-between for other locations. The daily temperature ranges are less for the coal terminal (about 7 – 8 °C) and are more near the mine (about 13 – 15°C), with other sites in between. In the cooler winter months, the mean daily maximum temperature drops to 23 – 25 °C at these locations, and mean daily minimum temperature drop to 13.5°C at the coal terminal and as low as 7.6°C at the mine, and in-between for other locations.

The temperature inversion strength and frequency have been estimated based on TAPM meteorological modelling output for the year 2008 for mine and the coal terminal. Inversions occur for a greater percentage of the time at the mine site than at the coal terminal.

This is because temperature inversions are more pronounced over land than near water, as water holds its heat for longer than land does. Therefore, it can be expected that the frequency of inversions will increase as the rail moves inland from the coal terminal to the mine.

10.2.2.2 Existing Air Quality

DERM monitor ambient air levels across major populated districts across the state. These levels are assessed to comply against the National Environmental Protection (Ambient Air Quality) Measure and the EPP (Air). Due to the general remoteness of the rail, there are no regulatory ambient air quality monitoring stations in the near vicinity. The closest DERM air quality monitoring station is located at West Mackay. West Mackay is located in a light industrial area, which often observes high levels of dust, attributed to local industries. Table 2 summarises recent dust monitoring data at West Mackay over a five year period.

Existing emission sources for the length of the rail are due to agricultural land use practices, occasional impacts from biogenic emissions, regional dust storms and fires, and are expected to be relatively low.

Estimating existing background dust level for the rail from the West Mackay Station data is a conservative approach, as air quality emissions are substantially higher across the region of Mackay due to light industry, and are not representative of background air quality along the rail.

For the purposes of this EIS assessment, and considering the predominantly rural environment within the study area, the estimated background levels for dust are:

- 26 µg/m³ for 24-hour average PM_{10} levels (70th percentile of 24-hour concentrations, averaged during 2006-2009);
- 22 µg/m³ for annual average PM_{10} levels (annual average concentrations, averaged during 2006-2009);
- 5.2 µg/m³ for 24-hour average $PM_{2.5}$ levels (20% of PM_{10} values, based on Midwest Research Institute, 2006);
- 4.4 µg/m³ for annual average $PM_{2.5}$ levels (20% of PM_{10} values, based on Midwest Research Institute, 2006); and
- 44 µg/m³ for annual average TSP levels (twice PM_{10} values, based on Midwest Research Institute, 2006).

The use of 20% of PM_{10} to estimate $PM_{2.5}$ background concentrations is based on Midwest Research Institute (2006), in which the recommended ratio of $PM_{2.5}$ to PM_{10} is 0.2 for agriculture activities, which is applicable to the rail where terrestrial wind erosion is presumably the major source of background dust emissions.

10.2.2.3 Sensitive Receptors

A large proportion of the proposed rail easement will traverse uninhabited regions; however, nineteen individual residents or regional towns along the proposed corridor have been identified as sensitive receptors (refer to Figure 1).

Table 2. Recent dust monitoring data at West Mackay

YEAR	PM_{10} CONCENTRATIONS (µg/m³) 24 HOUR PERIOD			
	MAX	95TH PERCENTILE	70TH PERCENTILE	ANNUAL AVERAGE
2006	106	31	22	19.6
2007	58	37	25	21.5
2008	94	43	27	23.3
2009	515	48	28	24.4*
EPP (Air) Guideline	50			No Guideline

* All data from 23 – 30 September 2009, extremely high values due to regional dust storms, are not included in the calculation of annual average.

10.2.3 POTENTIAL IMPACTS

10.2.3.2 Construction Emission Sources

Air emissions during the construction phase of the rail easement will be primarily dust related. Emissions of combustion-related pollutants, such as nitrogen oxides and volatile organic compounds (VOCs) from diesel construction equipment and vehicles are expected to be minor. Dust emission sources include clearing of vegetation and topsoil, excavation works, blasting, transportation movements, and temporary activities associated with quarries along the proposed alignment.

Due to the short duration that potential impacts are expected to occur during construction, they have not been predicted through air dispersion modelling. Rather they will be managed via dust management practices outlined in the EMP. This will include measures to minimise dust emissions and procedures that will be implemented to mitigate off-site impacts.

10.2.3.2 Operation Emission Sources

Emissions due to wind erosion of the coal surface of open coal wagons have been identified as the major source of dust emissions from coal transport on rail easements (Connell Hatch, 2008). As such, only emissions from this source were estimated and modelled to assess air quality impacts.

Emissions resulting from entrainment of particulate matter from the tracks, leakage of dust from the doors of loaded wagons and wind erosion from dust spilled on the rail easement were not included in this assessment as they were not considered significant sources compared to the emissions of particulate matter from the open coal wagons (Connell Hatch, 2008). Particulate matter emissions from diesel combustion in the locomotives were estimated to be less than 1% of emissions from the coal trains, and were therefore not included in the modelling.

Emissions of combustion-related pollutants, such as nitrogen oxides and VOCs from diesel construction equipment and vehicles are expected to be minor, and therefore no detailed study was undertaken.

10.2.3.3 Estimated Dust Emissions and control measures

Emissions of fugitive TSP emissions from coal wagons were estimated using the methodology presented in the *Interim Report Environmental Evaluation of Fugitive Coal Dust Emissions from Coal Trains Goonyella, Blackwater and Moura Coal Rail Systems* prepared for Queensland Rail Limited (Connell Hatch, 2008).

In this, the emission factor was calculated using the following equation (Connell Hatch, 2008):

$$EF_{TSP} = k_1.V^2 + k_2.V + k_3$$

where:

EF_{TSP}	=	Emission factor	(g/km/tonne)
k_1-k_3	=	Constants	(-)
V	=	Air velocity over the surface of the train	(km/h)

This emission factor is based on monitored emission rates from a coal rail system in Portugal (no relevant data from Australia were available). The railway system in the Portugal study was transporting coal from a port to a power station, located in a region with a similar climate to the study area, in that both regions are characterised by a marked wet and dry season. It has been assumed that the coal used to develop the emissions factor is product coal with similar moisture content to the coal produced by the mine. To be conservative, reduced emissions during periods of rainfall of the coal have not been considered.

In this assessment, the coal tonnage transported via this line is proposed to be 400 million tonnes per annum (Mtpa). The air velocity over the surface of the train was assumed to be the maximum proposed train travel speed of 80 km/hr. Its variation due to ambient wind speed and wind direction was not considered.

Reducing the speed of the train would result in lower emissions. For example, reducing train speed from 80 km/hr to 60 km/hr could reduce the TSP emissions by 45%, as illustrated in Figure 2.

Figure 1. Location of the Rail and Identified Nearby Sensitive Receptors

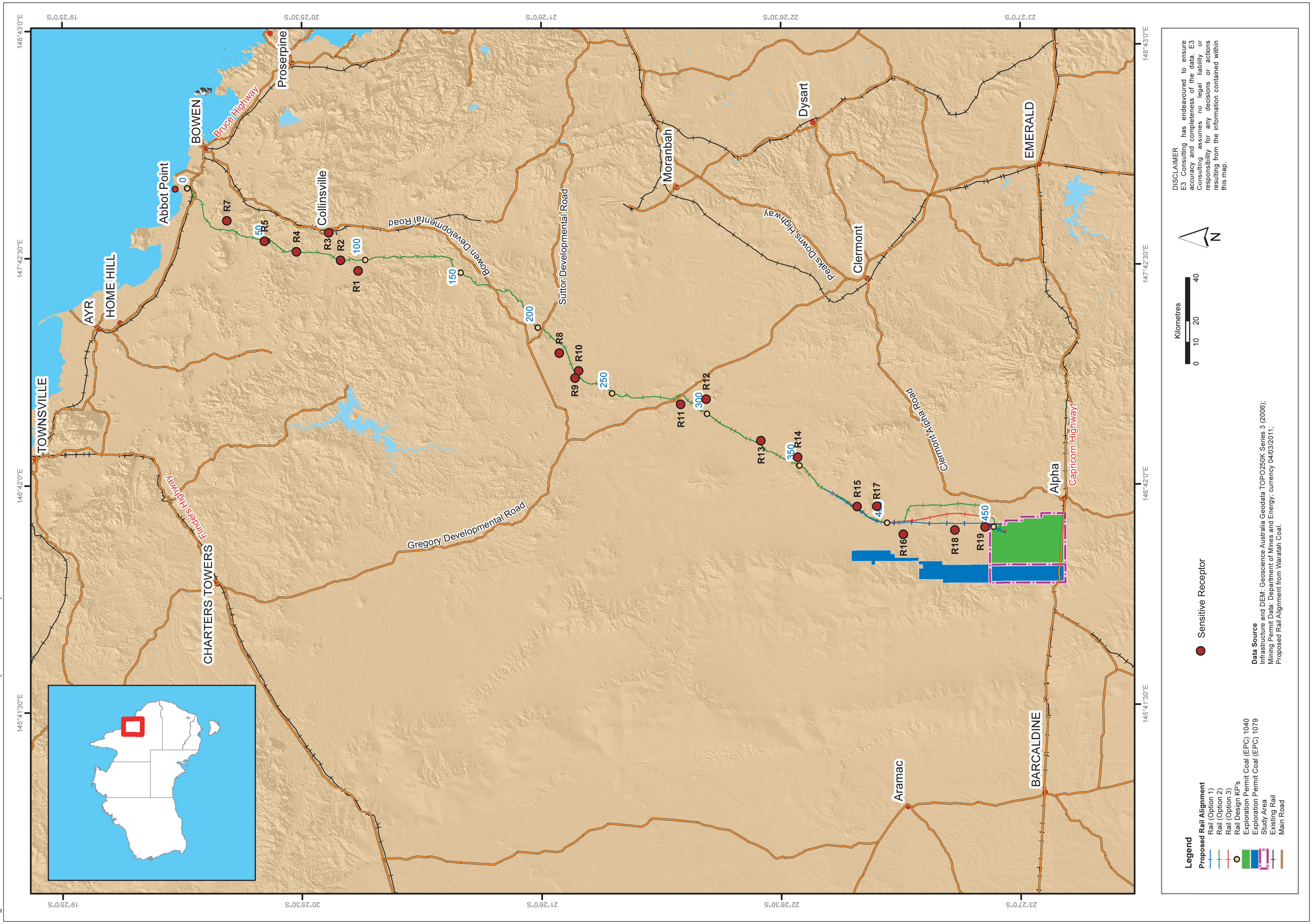
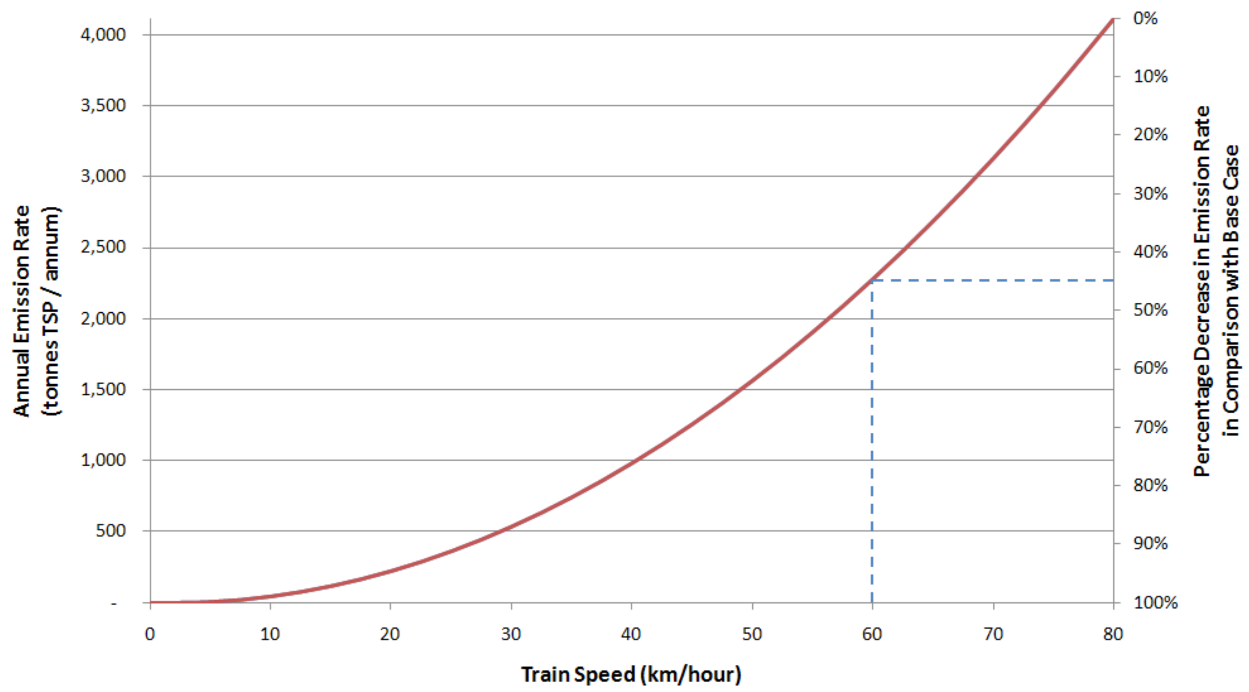


Figure 2. Relationship between Locomotive Speed and TSP Emissions (in a Calm Ambient Wind Condition)



Note: Base case represents locomotive speed of 80 km/hour, as used in the emissions estimation and dispersion modelling.

The following dust control methods are proposed with the aim to reduce dust emissions by 80%:

- Implementing partial covers for the coal wagons; and/or
- Wetting down the coal in each wagon before leaving the coal mine.

PM_{10} emissions have been estimated using a 50% fraction of TSP, adapted from the PM_{10} ratio of TSP for wind erosion, as sourced from the NPI EET Manual for Mining v2.3 (2004). $PM_{2.5}$ emissions have been estimated using a 12.5% PM_{10} based on Chapter 13.2.2.5 of the USEPA AP-42 - *Compilation of Air Pollutant Emissions*. Estimated annual emission rates are presented in Table 3. These emission rates, taken as constant values, were used in the AUSPLUME modelling.

Table 3. Estimated annual emissions

POLLUTANT	EMISSIONS (KG/ANNUM)	% OF TSP
TSP	8,229,774	100%
PM_{10}	4,114,887	50%
$PM_{2.5}$	514,360	6.25%

10.2.3.4 Predicted Impacts

Dust impacts were predicted by the AUSPLUME dispersion model for different representative sections of the rail, and for different directions of train travel.

The modelled emissions are constant with respect to time, at the rate presented in Table 3 (but converted to g/s). In reality dust emissions will vary greatly with respect to time, with emissions at a given point along the track only occurring as a train passes. However, as predicted dust impacts will be assessed against a guideline averaging period of 24 hours or longer, and there will be many trains passing by a single point on the track in a day, the use of constant emission rates is not a significant compromise.

The model results in this section are presented as line plots in Figure 3 to Figure 7, showing maximum predicted values at various distances from the track, for locomotive travelling in different directions: north, northeast or east..

10.2.3.4.1 PM_{10}

The predicted maximum 24-hour PM_{10} ground-level concentrations are presented in Figure 3. They indicate that, irrespective of what direction the locomotive is heading, near the mine, exceedances of PM_{10} EPP (Air) 24-hour objective of 50 µg/m³ will occur at locations close to the rail, up to 300 m. However, the predicted concentrations are much lower near the coal terminal, with no exceedances predicted.

10.2.3.4.2 $PM_{2.5}$

Figure 4 and Figure 5 presents the maximum 24-hour and annual average $PM_{2.5}$ ground-level concentrations, in comparison with EPP (Air) objectives. Modelling results predict $PM_{2.5}$ concentrations will not exceed the EPP (Air) objectives. Note that in this section, only the worst case scenarios are presented, in which the locomotive is heading north.

Figure 3. Predicted Maximum 24-hour PM_{10} Concentrations, including a Background Level of 26 μg/m³.

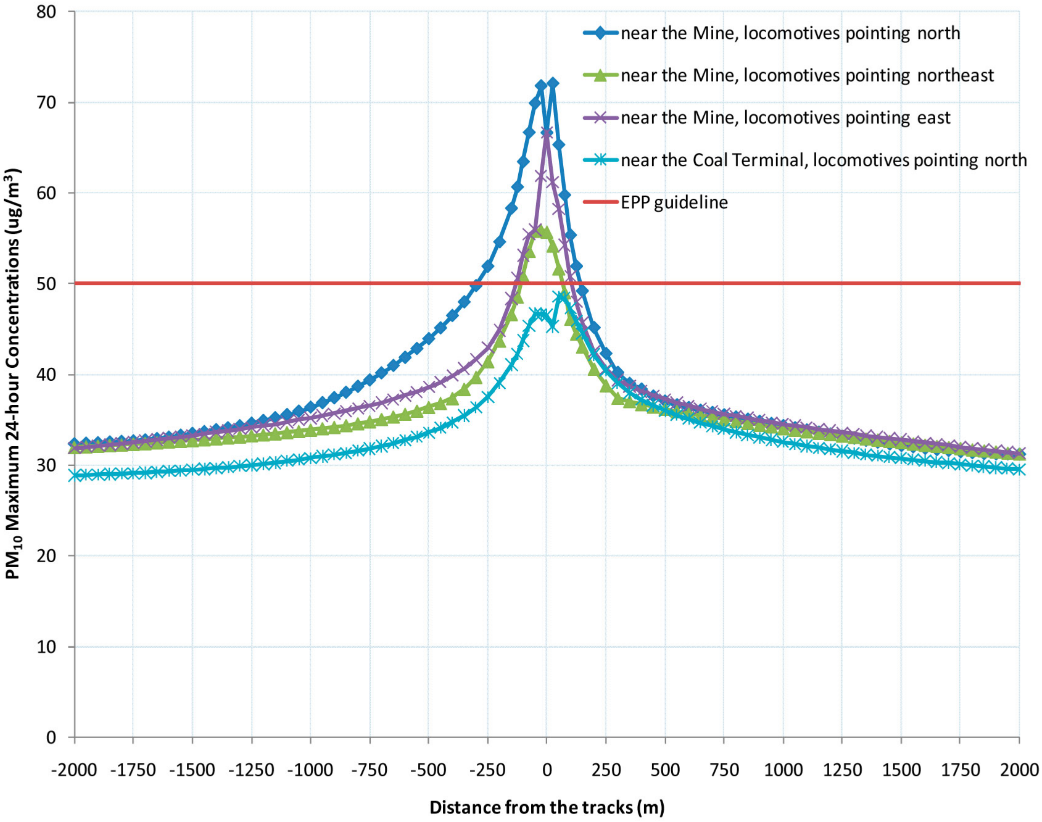
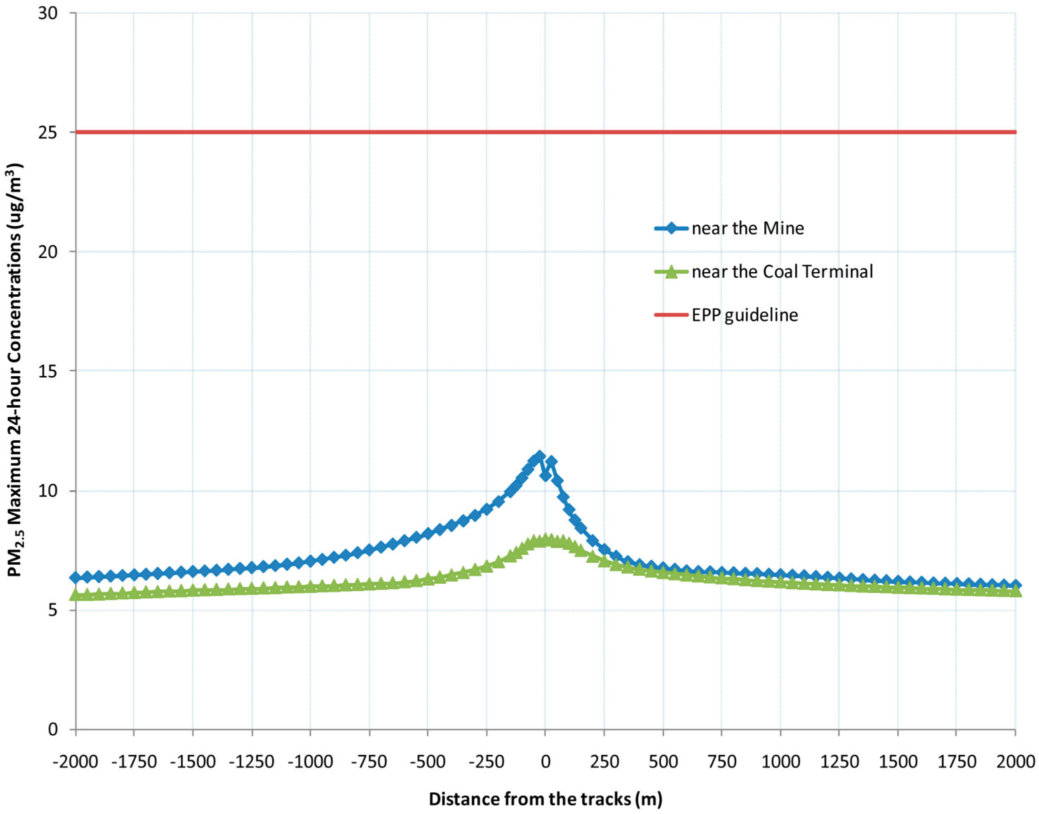


Figure 4. Predicted Maximum 24-hour Averaged $PM_{2.5}$ Concentration, including a Background Level of 5.2 μg/m³ (Locomotives Heading North)



10.2.3.4.3 Total Suspended Particles

Predicted annual average ground-level concentrations of TSP are presented in Figure 6 and Figure 7. They show the maximum concentrations occur when the locomotive is heading north; however, these concentrations are well below the EPP (Air) objective.

10.2.3.4.4 Coal Dust Deposition

Figure 7 presents the modelling results for dust deposition when the locomotives are heading north, based on meteorology for both mine and coal terminal. No exceedances of the dust deposition guideline are predicted.

10.2.3.4.5 Sensitive Receptors

Table 3 lists the distances of sensitive receptors to the rail and predicted dust impacts at these receptors. No exceedances of particulate matter guidelines are predicted at any sensitive receptors.

The closest sensitive receptor (number 4) is approximately 70 m away from the rail, located near a section of the track where the laden coal trains travel in a northerly direction and near the proposed coal terminal (refer to Figure 1). No exceedances of particulate matter guidelines are predicted at sensitive receptor 4. All other receptors are at least 500 m away, hence with sufficient buffer distances for dust impacts.

Figure 5. Annual Averaged $PM_{2.5}$ Concentration, including a Background Level of 4.4 μg/m³ (Locomotives Heading North)

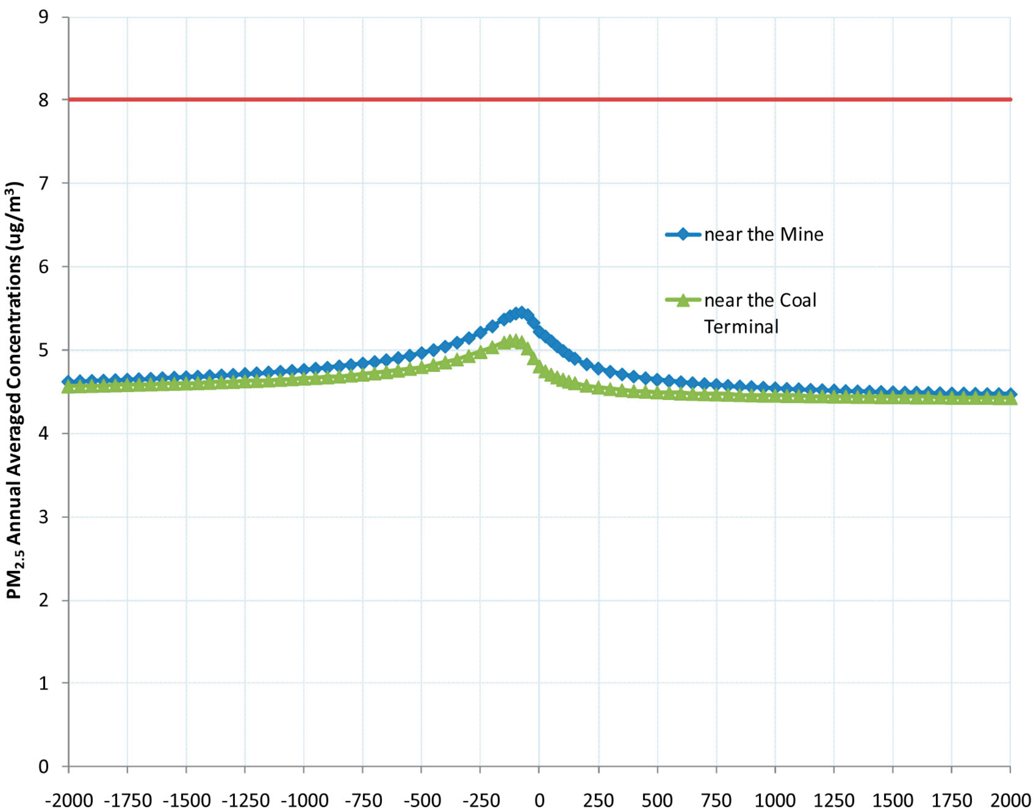


Figure 6. Annual Averaged TSP Concentration (Locomotives Heading North)

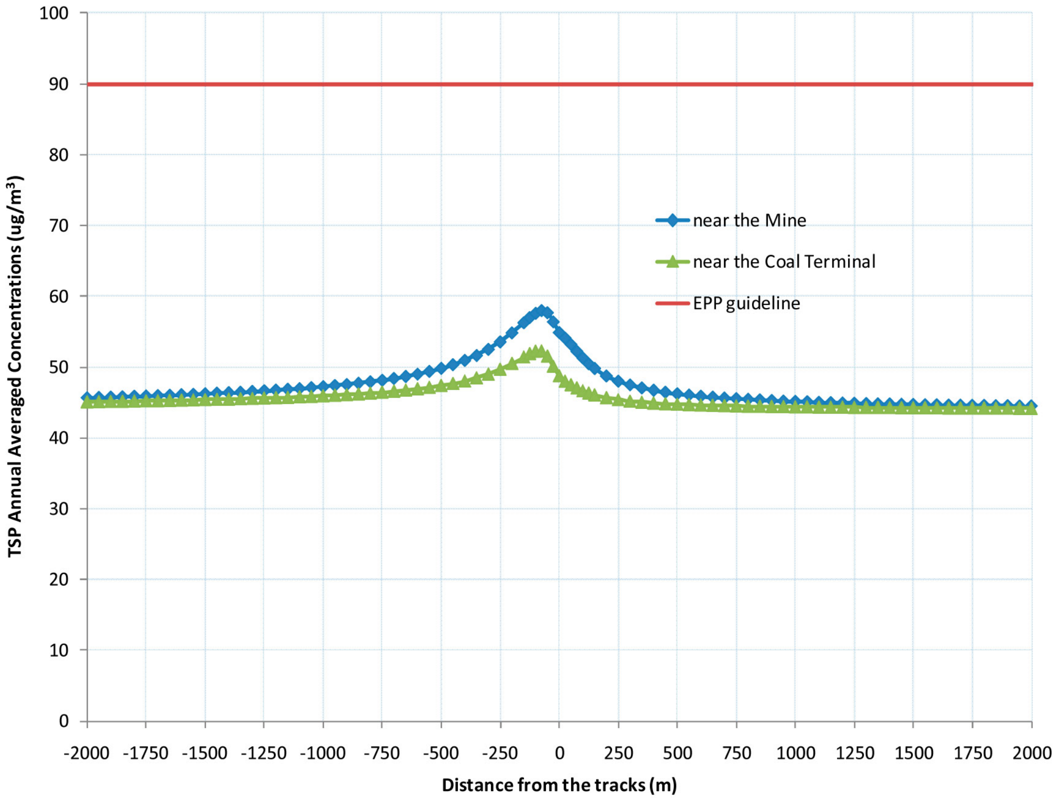


Figure 7. Dust Deposition (Locomotives Heading North)

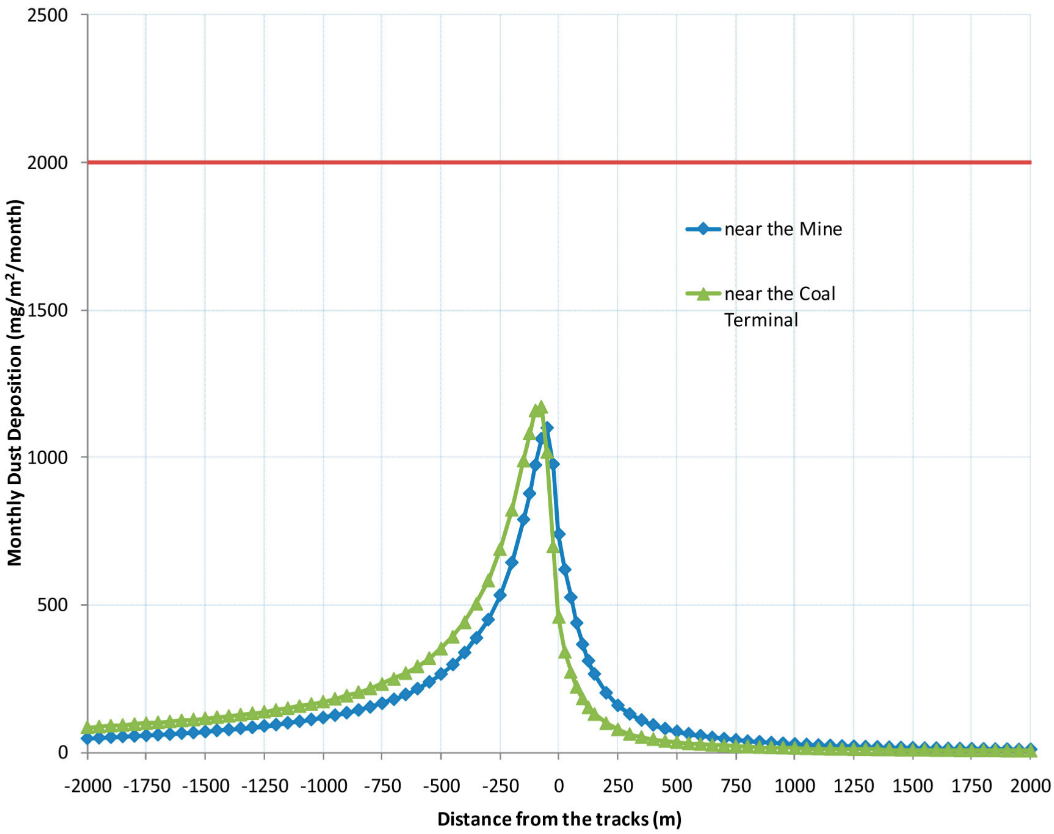


Table 4. Location of Sensitive Receptors and Predicted Exceedances

RECEPTOR	LONGITUDE	LATITUDE	DISTANCE FROM TRACK (M)	EXCEEDANCE
1	147.6632	-20.672139	> 4,900	None predicted
2	147.7109	-20.599801	> 500	None predicted
3	147.836	-20.546075	> 9,800	None predicted
4	147.7469	-20.408694	70	None predicted
5	147.7958	-20.273937	> 400	None predicted
6	147.7761	-20.214708	> 3,000	None predicted
7	147.8882	-20.11437	> 4,000	None predicted
8	147.296	-21.519461	> 3,100	None predicted
9	147.2111	-21.597091	> 1,300	None predicted
10	147.1875	-21.586234	> 500	None predicted
11	147.0668	-22.028334	> 700	None predicted
12	147.0897	-22.12867	> 5,200	None predicted
13	146.907	-22.360906	> 2,200	None predicted
14	146.8245	-22.513251	> 2,700	None predicted
15	146.6006	-22.762723	> 600	None predicted
16	146.4777	-22.958648	> 4,300	None predicted
17	146.6054	-22.846446	> 5,500	None predicted
18	146.4961	-23.173543	> 2,100	None predicted
19	146.5084	-23.302817	> 1,000	None predicted

10.2.4 AIR QUALITY MITIGATION MEASURES

Mitigation and management measures will be developed and implemented to meet air quality objectives and guidelines during both construction and operational phases of the rail project through an EMP.

10.2.4.1 Construction Activities

The dust mitigation measures during the construction phase of the rail will include:

- implementing water sprays on unsealed roads, keeping vehicles to well-defined roads, minimising vehicle distances between construction sites to spoil stockpiles, and restricting vehicle speed to reduce wheel-generated dust generation;
- treating or covering stockpiled materials to reduce wind erosion;
- ensuring all vehicles and machinery are regularly cleaned to prevent greater dust emissions;
- designing and developing roads to route away from any sensitive areas;
- minimising topsoil and vegetation removal, and revegetating disturbed areas as soon as possible; and
- monitoring daily visual dust events at the construction site, and ramping down construction activities in the instance of high dust events.

10.2.4.2 Operational Activities

To meet the air quality objectives during the operational phase of the rail, the following dust control measures have been proposed for this project. They are

- Implementing partial covers for the coal wagons; and/or
- Wetting down the coal in each wagon before leaving the coal mine to bind surface coal particles and provide a crust that is resistant to dust lift off.

Additional dust mitigation and management options, some of which were adapted from the *Queensland Rail Dust Management Plan* (2010), may be considered in the EMP. They are

- ensuring flat coal wagon loading as a standard practice and policy, to reduce wind erosion from the surface and coal spillage;
- brushing off excess coal on wagon sill immediately after the coal is loaded, to minimise parasitic coal that dislodges and falls off the wagon during transit;
- determining the dustiness of coal being transported, to allow for preventative measures to be taken to reduce dust emissions;
- altering the design of rail route during the planning phase of the project, to ensure sufficient buffer distances for sensitive receptors;
- consideration and management of locomotive speed (slowing speed can significantly reduce dust emissions); and
- considering the installation of dust monitors if dust presents a significant problem for some communities after the rail becomes operational, with mitigation measures selected based on the outcome of monitoring.

10.2.5 CONCLUSION

An air quality assessment was undertaken for the proposed rail project. The assessment method was conducted to satisfy requirements in the ToR. Predicted air quality impacts are compared with relevant air quality guidelines, especially those specified in the *Environmental Protection Policy (Air) (2008)*.

Dust impacts during the operational phase of the Project were assessed for representative portions of the rail, in terms of ground-level concentrations of PM_{10}, $PM_{2.5}$ and TSP as well as dust deposition. Results from the atmospheric dispersion modelling indicate that the dust impacts drop very quickly with the distance from the rail. Dust generated from coal wagons will not lead to exceedances of the guidelines at sensitive residential locations. However, near the mine, the 24-hour PM_{10} guideline of 50 µg/m^3 could be exceeded for up to 300 m downwind of the rail. No exceedance of the guidelines is expected at sensitive receptors.

Proposed dust mitigation measures adapted from *Queensland Rail Dust Management Plan (2010)* will ensure that emissions from the Project will not diminish or degrade the ambient air quality to the extent that it will adversely impact human health. This will be achieved through Waratah's EMP and application of dust mitigation measures.

Waratah will be able to sustain rail activities in accordance with its commitment principles through the introduction and continuous review of dust management and mitigation systems during the construction and operational phases of the corridor.

10.3 GREENHOUSE GASES

10.3.1 INTRODUCTION

GHG emissions and associated climate change impacts are a global issue. There are various relevant international and national legislative frameworks, with some being indirectly related to this project, and others for which compliance is mandatory.

The Kyoto Protocol requires developed countries to meet national targets for GHG emissions over a five year period between 2008 and 2012. Australia has ratified the Kyoto Protocol. Under the protocol, Australia is legally required to take domestic action to reduce greenhouse emissions. Australia's national target is to achieve an average of 108% of 1990 emissions for the five years of the first commitment period (2008-2012). Any new sources that begin emitting during this period will contribute to Australia's Kyoto target. As the Kyoto Protocol is applied on a national level, it is only indirectly related to this project.

National Greenhouse and Energy Reporting Act 2007 (NGER Act) establishes mandatory corporate and facility thresholds for GHG emissions reporting, as listed in Table 5. Based on the findings of this study, annual GHG emissions from the Project will exceed the National Greenhouse and Energy Reporting (NGER)

Table 5. NGER Reporting Thresholds

YEAR	CORPORATE THRESHOLD		FACILITY THRESHOLD	
	GHG EMISSIONS (kt CO_2-e)	ENERGY USAGE (TJ)	GHG EMISSIONS (kt CO_2-e)	ENERGY USAGE (TJ)
2008-2009	125	500	25	100
2009-2010	87.5	350		
2010-2011	50	200		

System corporate and facility thresholds (refer to Section 10.3.2.2 for emission estimates). Therefore, Waratah Coal will be required to report GHG emissions and energy consumption from the overall project.

The primary references for emission factors are the NGA Factors (2009) and the NGER Technical Guidelines (2009), using the most recent versions at the time of the assessment.

The Energy Efficiency Opportunities (EEO) Program is designed to improve the energy efficiency of large businesses. Participation is mandatory for corporations that use more than 0.5 PJ of energy. Participating corporations must assess their energy efficiency and energy efficiency opportunities that have a payback period less than four years and publicly report the results. Based on expected electricity and diesel usage, the Project will exceed the EEO participation threshold of 0.5 PJ (refer to Volume 5, Appendix 19 for a summary of total energy usage).

Other proposed legislation that may impact this project includes the proposed national Direct Action Plan and Clean Energy Future Plan. There are a lot of uncertainties at this stage on which will eventually be implemented, however a carbon emission pricing scheme could be in place by July 2012.

10.3.2 EMISSION INVENTORY

10.3.2.1 Methods

GHG emissions have been estimated based upon the methods outlined in the following documents:

- *Greenhouse Gas Protocol*, by the World Resources Institute and World Business Council for Sustainable Development;
- *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines* (NGER Technical Guidelines, 2009), by the Australian Government Department of Climate Change (DCC); and
- *National Greenhouse Accounts Factors* (NGA Factors, 2009), by DCC.

The *Greenhouse Gas Protocol* establishes an international standard for accounting and reporting of GHG emissions. It defines three 'scopes' of emissions: scope 1, scope 2 and scope 3, for GHG accounting and reporting purposes.

The scope 1 emissions are direct GHG emissions that occur from sources that are owned or controlled by the reporting entity. The scope 2 emissions are a category of indirect emissions that accounts for GHG emissions from the generation of purchased energy products (principally, electricity, steam/heat and reduction materials used for smelting) by the entity. Scope 2 in relation to the Project covers purchased electricity. Scope 3 emissions are defined as those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Scope 3 emissions associated with the Project have not been estimated, in accordance with the requirements of Section 3.6: Greenhouse gas abatement and emissions of the ToR.

With respect to the rail construction, the sources of scope 1 emissions are the combustion of diesel fuels for transport and stationary energy, as well as the clearing of vegetation. As project-specific data was not available for this stage of the project, the construction stages of other rail projects of similar type and scale were assessed in order to approximate the project's construction emissions. This process determined key activity data on a per km of rail basis.

To estimate scope 1 and scope 2 emissions during operation of the rail, project-specific activity data were used.

The primary references for emission factors are the *NGA Factors* (2009) and the *NGER Technical Guidelines* (2009), using the most recent versions at the time of the assessment.

10.3.2.2 Estimated GHG Emissions

A summary of the calculated emissions for the construction of the rail is presented in Table 6.

Scope 1 GHG emissions for the construction of the rail easement are estimated to be approximately 517,995 t CO_2-e. No scope 2 emissions were assessed for the construction of the rail, as it was assumed that stationary energy would be sourced from diesel-fueled engines rather than from purchased electricity.

The bulk of the scope 1 emissions are associated with diesel combustion for transport energy purposes (85%), with land clearing contributing approximately 9%. The majority of total scope 1 emissions are CO_2 (99.1%), with a small amount of CH_4 (0.3%) and N_2O (0.6%) emissions.

A summary of the calculated annual emissions for the rail operation is presented in Table 7.

Scope 1 and 2 GHG emissions for the rail operation are estimated to be approximately 2,919,480 t CO_2-e per annum, with scope 1 and 2 emissions contributing approximately 95% and 5% of total emissions respectively. These figures represent annual emissions for the rail operation based on maximum coal transport capacity of 400 Mtpa.

Annual scope 1 GHG emissions are associated with diesel consumption in the locomotives. The majority of total scope 1 emissions are CO_2 emissions (99%), with CH_4 emissions (0.3%) and N_2O (0.7%) emissions representing the remainder. 100% of scope 2 emissions are associated with electricity consumption for activities along the rail easement.

10.3.3 ABATEMENT ACTIONS

GHG emissions from the Project can be most effectively managed through:

- the identification of major sources of GHG emissions through ongoing measurement, monitoring;
- improvements in energy efficiency;
- switching to less emissions intensive fuels; and
- offsetting emissions.

10.3.3.1 Emissions Measurement

Ongoing GHG emissions measurement is the first step towards effective mitigation. Measuring emissions indicates which sources have the greatest potential for emission reductions.

10.3.3.1.1 Mandatory Reporting

Annual reporting of GHG emissions from the Project will be mandatory under NGER. Emissions reportable under NGER are at high level, and will be attributed to total fuel and electricity consumption. NGER reporting will likely underpin any National GHG emissions reduction strategies, such as those outlined in the Clean Energy Future Plan.

10.3.3.1.2 In-house Reporting

To target specific emission sources, the *Australian Coal Association Research Program* (ACARP) recommends that emissions be measured at the activity or equipment type level (ACARP, 2001). This includes setting 'key emissions indicators' (KEIs), to compare the emissions intensity of similar activities. A KEI for the rail component of the Project is the t CO_2-e / t coal moved.

10.3.3.2 Switching to Less Emissions Intensive Fuels

Scope 2 emissions associated with electricity consumption are a large source of total scope 1 and 2 emissions for the rail. It is expected that the emissions intensity of the Queensland electricity grid will decrease, and that the associated emissions for the Project will decrease accordingly. The decrease will be due to:

- the *Queensland Gas Scheme* – which prescribes that Queensland electricity retailers source a percentage (currently 13% with the option to increase to 18%) of their electricity from gas-fired generators; and
- the *Mandatory Renewable Energy Target* – which is designed to deliver 20% renewable energy in Australia's electricity supply by 2020.

Table 6. Construction Emissions Summary

SOURCE	ACTIVITY DATA	UNITS	GREENHOUSE GAS	EMISSION FACTOR	EF UNITS	EMISSIONS	UNITS
Diesel consumption for transport purposes	6,282,403	GJ	CO_2	69.2	kg CO_2-e/GJ	434,742	t CO_2-e
			CH_4	0.2	kg CO_2-e/GJ	1,256	t CO_2-e
			N_2O	0.5	kg CO_2-e/GJ	3,141	t CO_2-e
			Total CO_2-e	69.9	kg CO_2-e/GJ	439,140	t CO_2-e
			Percentage of total Scope 1 emissions			85%	
Diesel consumption for stationary energy purposes	493,695	GJ	CO_2	69.2	kg CO_2-e/GJ	30,704	t CO_2-e
			CH_4	0.1	kg CO_2-e/GJ	44	t CO_2-e
			N_2O	0.2	kg CO_2-e/GJ	89	t CO_2-e
			Total CO_2-e	69.5	kg CO_2-e/GJ	30,837	t CO_2-e
			Percentage of total Scope 1 emissions			6%	
Vegetation clearing	291	ha	CO_2	165	t CO_2-e/ha	48,019	t CO_2-e
			Total CO_2-e	165	t CO_2-e/ha	48,019	t CO_2-e
			Percentage of total Scope 1 emissions			9%	
Total CO_2						513,465	t CO_2-e
Total CH_4						1,301	
Total N_2O						3,230	t CO_2-e
Total Scope 1 CO_2-e						517,995	t CO_2-e
TOTAL GREENHOUSE GAS EMISSIONS						**517,995**	t CO_2-e

Table 7. Operational Emissions Summary

SOURCE	ACTIVITY DATA	UNITS	GREENHOUSE GAS	EMISSION FACTOR	EF UNITS	EMISSIONS	UNITS
Rail Diesel Consumption	39,535,790	GJ/a	CO_2	69.2	kg CO_2-e/GJ	2,735,877	t CO_2-e/a
			CH_4	0.2	kg CO_2-e/GJ	7,907	t CO_2-e/a
			N_2O	0.5	kg CO_2-e/GJ	19,768	t CO_2-e/a
			Total CO_2-e	69.9	kg CO_2-e/GJ	2,763,552	t CO_2-e/a
			Percentage of total Scope 1 emissions			100%	
Scope 2 – Rail Electricity Consumption	175,200	MWh/a	Scope 2 CO_2-e	0.89	t CO_2-e/MWh	155,928	t CO_2-e/a
Total CO_2						2,735,877	t CO_2-e/a
Total CH_4						7,907	
Total N_2O						19,768	t CO_2-e/a
Total Scope 1 CO_2-e						2,763,552	t CO_2-e/a
Total Scope 2 CO_2-e						155,928	t CO_2-e/a
TOTAL GREENHOUSE GAS EMISSIONS						**2,919,480**	t CO_2-e/a

Scope 1 emissions associated with fuel combustion can be reduced by replacing diesel with less emissions intensive fuel, such as biodiesel, which can be used as a supplement fuel in the locomotives.

10.3.3.3 Third Party Offsets

The Project can offset its emissions by investing in third party projects that reduce GHG emissions below a demonstrated baseline. Examples of projects that reduce emissions are:

- forestry projects that reduce emissions by
  - sequestering carbon through reforestation or afforestation, or
  - prevent deforestation;
- increase the carbon contained in soils through soil management;
- renewable energy, such as wind farms, geothermal or solar; and
- destruction of methane produced from landfills, wastewater treatment plants etc.

10.3.4 CONCLUSION

GHG emission sources from the Project have been identified for the rail.

Construction of the rail easement is project to result in emissions of 517,995 t CO_2-e. The majority of these emissions (85%) are from the combustion of diesel for transport energy purposes.

Annual GHG emissions have been estimated using applicable and recognised methodologies for reporting. It is expected that during operation the rail will produce 2,919,480 t CO_2-e per annum. Scope 2 emissions account for 5% of total emissions for the rail, and have been estimated using the emission factor for electricity purchased from the Queensland grid. The remaining 95% are scope 1 emissions, which are direct emissions associated with diesel consumption in the locomotives.

GHG emissions from all aspects of the Project, including the rail, will have to be annually reported under the requirements of NGER, and Waratah Coal will be a direct participant in the emissions scheme included in the Clean Energy Future Plan as it is currently proposed. It is also expected that Waratah Coal will have to assess the energy efficiency of the Project, and identify measures to improve energy efficiency, under the EEO Program.

The Project can most effectively reduce its annual emissions through improvements in energy efficiency. Waratah Coal is committed to undertaking ongoing internal measurement and monitoring of emissions, in addition to mandatory reporting under NGER and the EEO Program. The focus of the monitoring will be to identify sources with the greatest potential for emissions reductions. GHG emissions may also be offset through investment in third party projects that reduce emissions below a demonstrated baseline, for example, through forestry and renewable energy projects.

10.4 COMMITMENTS

In managing potential air quality impacts and implementation to various control measures in the reduction of dust emissions associated with the operation phase of the proposed rail easement, Waratah will meet air quality objectives by:

- assessing and investigating the use of chemical veneer sprays in reducing fugitive dust loads from coal locomotives;
- implementation of control measures for dust load such as coal moisture regulating systems, coal loading systems designed to minimise exposed areas and coal spillage;
- instigating cleaning and monitoring programs for coal wagons of spilled coal and dustiness of coal being transported;
- managing locomotive speed along the rail easement;
- installation and maintaining of dust monitoring equipment at sensitive locations along the proposed corridor;
- co-operative collaboration with other proposed large-scale mining developments across the region. A requirement to manage dust emissions to levels below the adopted air quality guidelines is necessary from all parties; and
- continue ongoing consultation with the community.

The short term dust emissions associated with construction have not been quantified. These emissions are to be effectively managed through a dust management plan for construction.

In minimising the amount of GHG generated by rail easement, Waratah Coal commits to:

- developing ongoing processes for minimising energy consumption and GHG emissions within the Project, by investigating the use of renewable energy sources in the operation of the proposed rail easement;
- measure and report GHG emissions in compliance with the National Greenhouse and Energy Reporting System; and
- working with government on developing measures to address GHG emissions.